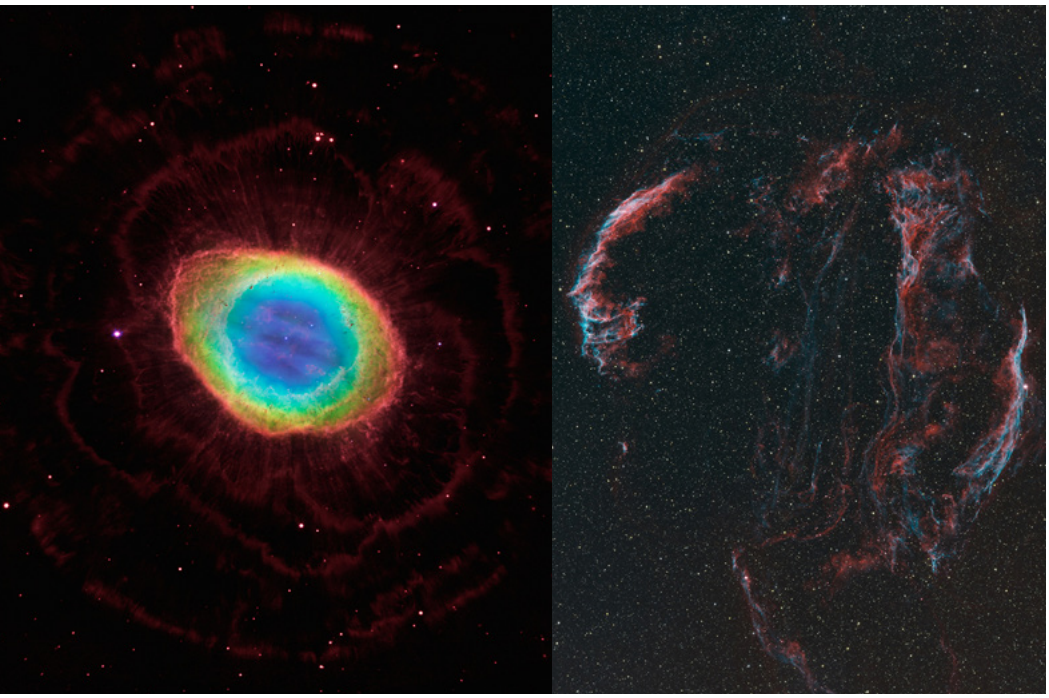
National Aeronautics and
Space Administration

UNIVERSE DISCOVERY GUIDES

July

RING NEBULA AND VEIL NEBULA



Wispy Remains of Dead Stars. *Left:* Ring Nebula. Credit: NASA , ESA , C.R. O'Dell (Vanderbilt University), and D. Thompson (Large Binocular Telescope Observatory). *Right:* Veil Nebula. NASA Astronomy Picture of the Day. Credit & Copyright: Martin Pugh

IN THIS GUIDE

Published 2013.

The universe is a place of change. NASA missions advance our understanding of the changing universe.

STELLAR RECYCLING

Have you ever walked through a forest and seen a fallen tree disintegrating on the ground? When a tree can no longer process energy to grow, it dies and falls. Over time, its leaves, branches, and trunk are broken down and provide nutrients to support future generations of trees and other forest dwellers. Eventually its resources are dispersed or consumed and its remains disappear.

Tree death substantially increases the resources available to the forest by recycling the nutrients built up in the tree over its lifetime.

Stars recycle their “nutrients” when they die, too. Over a star’s lifetime, it builds up a variety of elements in its core. When a star dies, those elements are released back into the galactic “forest” to build future generations of stars and other galactic dwellers.

Depending on a star’s mass when it dies, it will either slowly disintegrate, like that tree, or it will explode all at once in a spectacular supernova. You can see the remains of both kinds of stellar death in the sky.

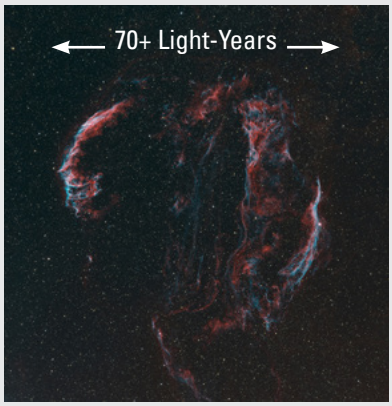
A smaller mass star, like our Sun, will gradually lose its outer atmosphere, forming a cloud of gas and dust that gently moves away from the star. The Ring Nebula is an example. It started forming about 7,000 years ago and has only reached an extent of about one light-year across, continuing to slowly expand. It will take thousands more years for it to disperse.

Ring Nebula. Credit: The Hubble Heritage Team (AURA/StScI/NASA)

Compare that to a larger mass star, like Antares in Scorpius, that will explode as a supernova, blasting most of its mass out into the galaxy. The debris violently blown off the star forms a rapidly expanding cloud around the site of the explosion. The Veil Nebula marks the site of supernova explosion that occurred around five to eight thousand years ago, roughly the same time frame as the Ring Nebula.

Unlike the Ring Nebula, at a compact one light-year across, the Veil has expanded to over 70 light-years across and today is almost completely dispersed. It is much more quickly recycling its resources back into the galaxy.

From a tree on the forest floor to each star in the sky, our universe is in a state of constant change and renewal.



Veil Nebula. NASA Astronomy Picture of the Day. Credit & Copyright: Martin Pugh

SKY FEATURE: RING NEBULA AND VEIL NEBULA

How to Find Them

RING NEBULA

Distance: 2,300 light-years

Visual Magnitude: 8.8

Apparent Dimension: 1.4 arcminutes

Actual dimension: About 1 light-year

To view: telescope

VEIL NEBULA (also called "Cygnus Loop")

Distance: 1,470 light-years

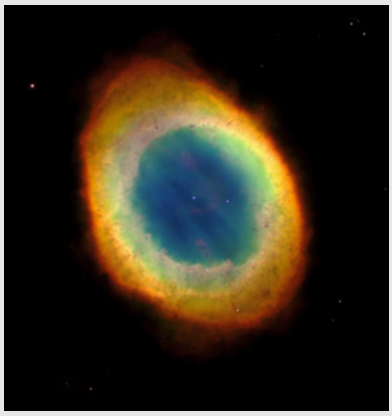
Visual Magnitude: 8.7

Apparent Dimension: 180 arcminutes
(It takes two fingers held at arm's length to cover it.)

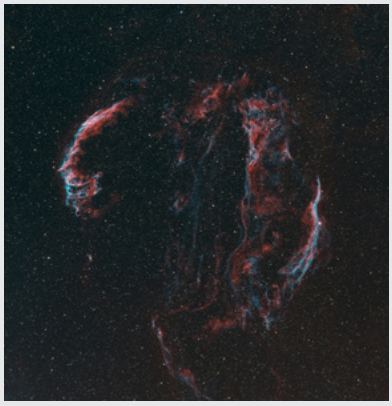
Actual dimension: More than 70 light-years

To view: telescope

Click here to jump to the full-sky July Star Map.



Ring Nebula. Credit: The Hubble Heritage Team (AURA/StScI/NASA)



Veil Nebula. NASA Astronomy Picture of the Day. Credit & Copyright: Martin Pugh

On a July evening before midnight, the Summer Triangle is found high above the eastern horizon. On the finder chart on the following page, the Summer Triangle is marked by dotted lines connecting the bright stars Deneb, Vega, and Altair. These are the brightest stars in the constellations Cygnus, Lyra, and Aquila, respectively.

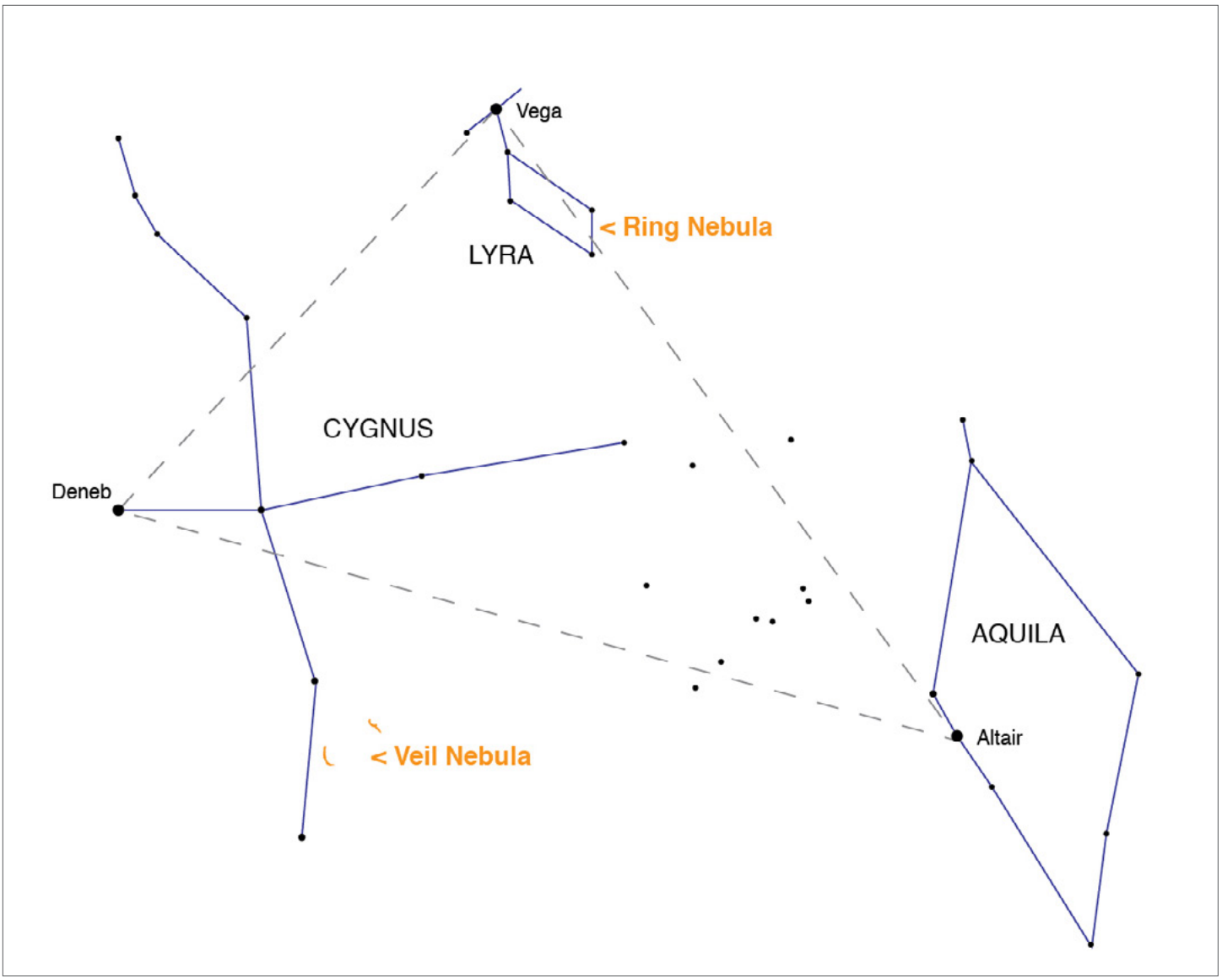
Two of the most amazing examples of stellar remains are found there, the Ring Nebula and the Veil Nebula.

The Ring Nebula is an example of what scientists call a "**planetary nebula**" because early astronomers viewing them through telescopes saw a round, planet-like object. Their true nature was discovered later, but the name was not changed.

The Veil Nebula is an example of what scientists call a "**supernova remnant**," the remains of a supernova explosion.

A dark sky and a telescope are your best chance to see these stellar remains. For access to amateur astronomers who will share views through telescopes with you, contact your local astronomy club on the NASA Night Sky Network: http://nightsky.jpl.nasa.gov/

Finder Chart

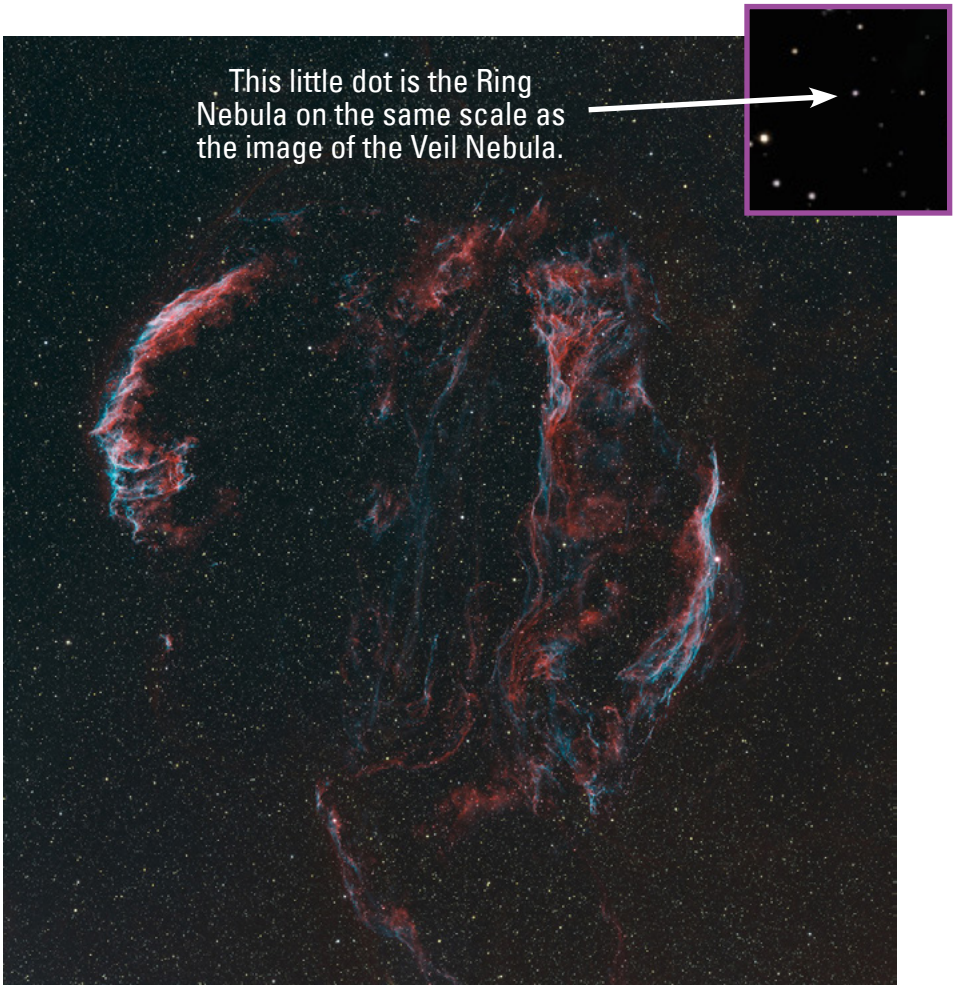


TRY THIS!

Compare the size of the Veil Nebula to the size of the Ring Nebula

Take a look at these images.

Remember they both started forming about the same time. A supernova explosion that creates a supernova remnant like the Veil is much more powerful than the gentler expansion that creates a planetary nebula like the Ring.



Veil Nebula. NASA Astronomy Picture of the Day. Credit & Copyright: Martin Pugh

Another way to compare the size of the Veil Nebula to the Ring Nebula

Imagine a bride wearing a long Veil and holding it out.

Compare that to the size of the Ring on her finger.

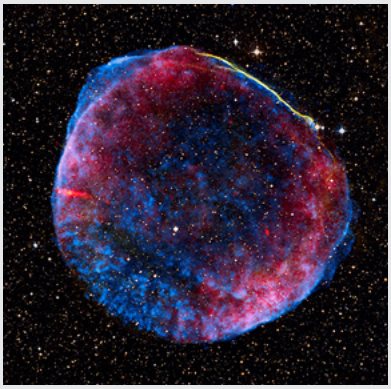
Photography courtesy of Anthony Turnham of SNAP! Wedding Photography

Explore another Supernova Remnant

In the year 1006, observers around the world witnessed the appearance of a new star, now known to be a supernova. Use the Hubble Space Telescope resource for supernova 1006 to learn what the unusual shape of this exploded star tells us about stellar death.

http://amazing-space.stsci.edu/resources/print/lithos/sn1006_litho.pdf

For more Hubble education and public outreach activities from the Space Telescope Science Institute, visit http://amazing-space.stsci.edu/



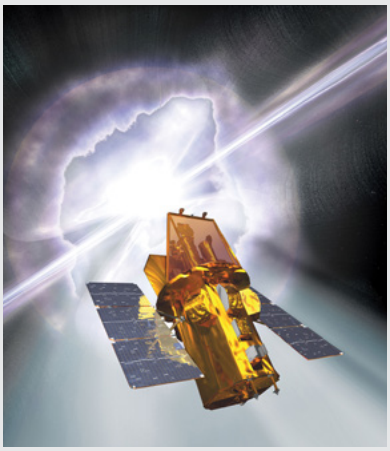
Credit: X-ray: NASA/CXC/Rutgers/G. Cassam-Chenaï, J.Hughes et al.; Radio: NRAO/AUI/NSF/GBT/VLA/ Dyer, Maddalena & Cornwell; Optical: Middlebury College/F. Winkler, NOAO/AURA/NSF/CTIO Schmidt & DSS

Exploding Stars are HOT!

Discover the secrets of supernovae using the Supernovae Educator Guide. This formal education resource contains four activities developed for the classroom that can be modified for the informal setting. Play a card game that teaches about supernovae, understand the expansion rate of gas from a supernova, explore the magnetic fields of strongly magnetic neutron stars, and explore neutron stars in the news.

http://xmm.sonoma.edu/edu/supernova/snguide13web.pdf

For more education and public outreach activities from Fermi, XMM-Newton, Swift, and NuSTAR, see the Space Science Education and Public Outreach website from Sonoma State University, visit http://epo.sonoma.edu/projects.php



Artist's rendering of the Swift spacecraft. Credit: Spectrum Astro

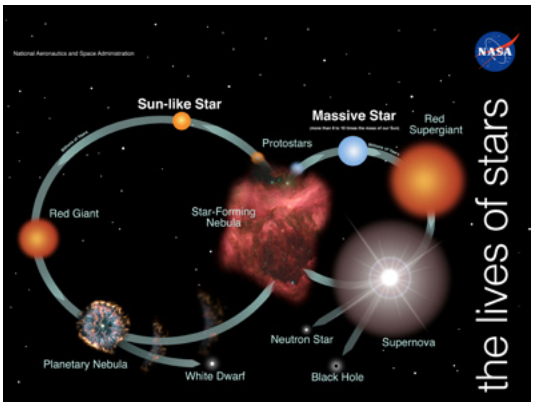
ACTIVITY: LIVES OF STARS

Time: 10–15 minutes

Age: 9 and up

In this activity, discover the life cycle of stars and when supernovae happen. Some may mistakenly think that the different stages in the life of a star are actually different types of stars, rather than just stages in the life of a single star. Does a butterfly look the same as it goes through different stages in its life? Neither do stars!

http://nightsky.jpl.nasa.gov/download-view.cfm?Doc_ID=393



Credit: Astronomical Society of the Pacific

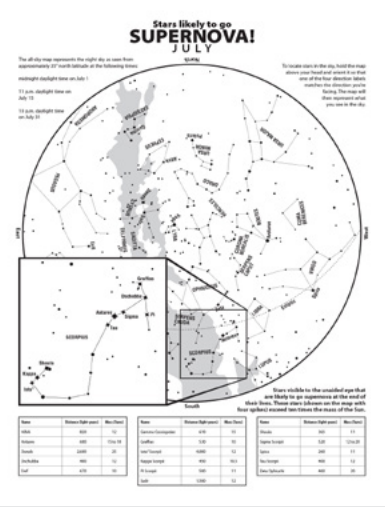
Which stars in the night sky will likely go Supernova?

Time: 5–20 minutes

Age: 9 and up

These star maps show you which stars are likely to go Supernova at the end of their lives. In July, the red supergiant star, Antares in the constellation of Scorpius, is one of the next ones that will explode! Use the star map to go outside tonight and find it.

http://nightsky.jpl.nasa.gov/download-view.cfm?Doc_ID=341



Looking for more Earth and Space Science formal and informal education activities?

Try out NASA's digital collection of resources at NASA Wavelength: http://nasawavelength.org

NASA WAVELENGTH
A Full Spectrum of NASA Resources for Earth and Space Science Education

http://nasawavelength.org

CONNECT TO NASA SCIENCE

How do we know?

How do we know the age of a supernova remnant?

http://imagine.gsfc.nasa.gov/docs/science/know_l2/supernova_remnants.html

NASA SCIENCE | ASTROPHYSICS

http://science.nasa.gov

Flowers and Filaments

When NASA's Spitzer infrared space telescope takes an image of the Ring planetary nebula, it looks like the delicate petals of a camellia blossom. What are we looking at, really? Find out here: http://www.spitzer.caltech.edu/images/1403-ssc2005-07a1-Infrared-Ring-Nebula

Credit: NASA/JPL-Caltech/J. Hora (Harvard-Smithsonian CfA)

For the latest news from Spitzer, visit http://www.spitzer.caltech.edu/news

Is this supernova remnant's odd shape evidence of our Galaxy's youngest black hole?

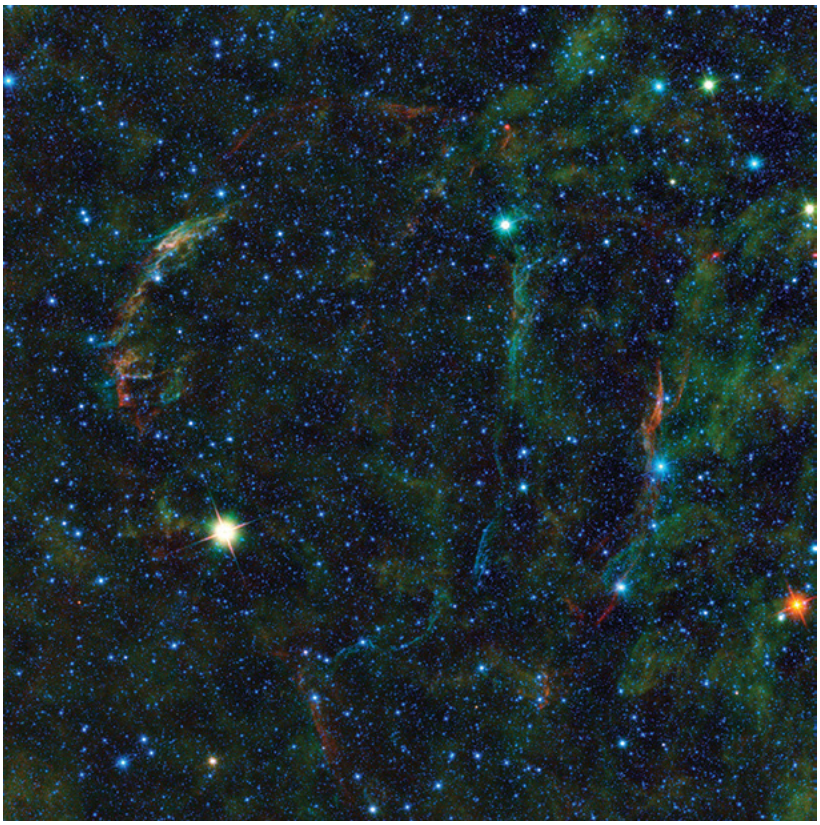
Find out here: http://chandra.harvard.edu/press/13_releases/press_021313.html

For the latest news from Chandra, visit http://chandra.harvard.edu/press/

Credit: X-ray: NASA/CXC/MIT/L. Lopez et al.; Infrared: Palomar; Radio: NSF/NRAO/VLA

NASA's WISE mission, another infrared space telescope imaged the Veil Nebula (also called the Cygnus Loop), revealing more wispy filaments of the dusty remains from the supernova explosion.
http://wise.ssl.berkeley.edu/gallery_veil.html

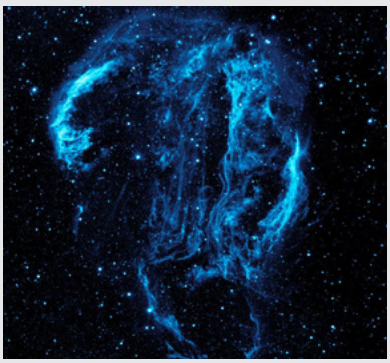
For the latest news from WISE, visit
http://wise.ssl.berkeley.edu/news.html



Credit: NASA/JPL-Caltech/WISE Team

Wispy tendrils of hot dust and gas glow brightly in this ultraviolet image of the Veil Nebula, taken by NASA's Galaxy Evolution Explorer (GALEX). The filaments of gas and dust were heated by the shockwave from the supernova, which is still spreading outward from the original explosion. The original supernova would have been bright enough to be seen clearly from Earth with the naked eye. Find out more here:
http://www.nasa.gov/mission_pages/galex/pia15415.html

For the latest news from GALEX, visit:
http://www.nasa.gov/mission_pages/galex/index.html



Credit: NASA/JPL-Caltech

ACKNOWLEDGEMENTS

The Universe Discovery Guides are a collaborative effort between members of the NASA Astrophysics education and public outreach (E/PO) community and the NASA Astrophysics Science Education and Public Outreach Forum. We also gratefully acknowledge the informal educators from the Astronomy from the Ground Up (AFGU) and the Sky Rangers communities who field-tested the guides.

Contributing NASA Astrophysics E/PO programs include: Afterschool Universe, Alien Earths, Astronomy Picture of the Day (APOD), the Chandra X-ray Observatory, the Cosmic Background Explorer (COBE), Cosmic Questions, the Euclid mission, Exoplanet Exploration, the Fermi Gamma-ray Space Telescope, the Galaxy Evolution Explorer (GALEX), the Herschel Space Observatory, the High Energy Astrophysics Science Archive Research Center (HEASARC), the Hubble Space Telescope, Imagine the Universe, the Infrared Processing and Analysis Center (IPAC), the James Webb Space Telescope, the Kepler Mission, the Milky Way Project, the Night Sky Network (NSN), the Nuclear Spectroscopic Telescope Array (Nu-STAR), Observing with NASA (OwN), Other Worlds, the Planck mission, PlanetQuest, Planet Hunters, the Spitzer Space Telescope, StarChild, the Stratospheric Observatory for Infrared Astronomy (SOFIA), the Swift mission, the Two Micron All-Sky Survey (2MASS), the Wide-Field Infrared Survey Explorer (WISE), the Wilkinson Microwave Anisotropy Probe (WMAP), the X-ray Multi-Mirror Mission (XMM-Newton), and Zooniverse.

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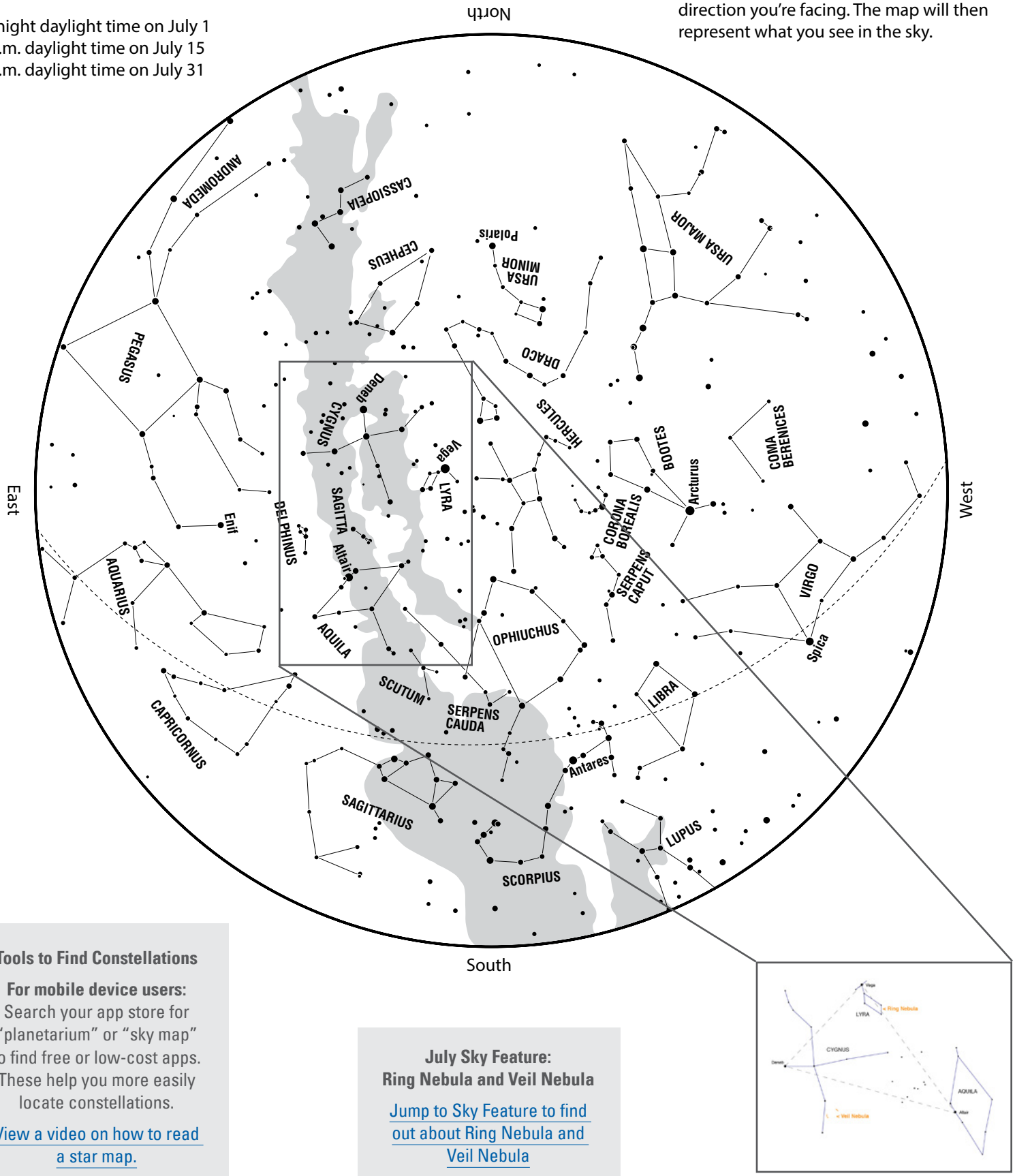
APPENDIX: JULY STAR MAP

The all-sky map represents the night sky as seen from approximately 35° north latitude at the following times:

midnight daylight time on July 1
11 p.m. daylight time on July 15
10 p.m. daylight time on July 31

To locate stars in the sky, hold the map above your head and orient it so that one of the four direction labels matches the direction you're facing. The map will then represent what you see in the sky.



Tools to Find Constellations

For mobile device users:
Search your app store for "planetarium" or "sky map" to find free or low-cost apps. These help you more easily locate constellations.

View a video on how to read a star map.

July Sky Feature:
Ring Nebula and Veil Nebula

Jump to Sky Feature to find out about Ring Nebula and Veil Nebula